

ART. IX.—*On the Nomenclature of Geological Age.*

BY G. B. PRITCHARD,

Lecturer in Geology, etc., at the Working Men's College ;
Acting Lecturer in Geology, Mineralogy, and Metallurgy at the
Melbourne University.

[Read before Section C of the Australasian Association for the
Advancement of Science, 12th January, 1900.]

As a teacher of geology I find one aspect of the subject which is continually causing difficulties and confusion to the students, is the very loose and indefinite use of the terms indicating geological age. In the present paper I hope to be able to point out a few of the inconsistencies and contradictions that have come under my notice in the course of my work, and to show the very peculiar state we have arrived at with regard to our Time Scale for the Australian Colonies.

Although many of us have been taught to recognise a general table of Geological Divisions of the Time Scale as of general use and world-wide application, we soon find that such is really not the case, and as Professor Scott has rightly remarked,¹ "The method of making the divisions and subdivisions of geological time is not yet a fixed one, and there is much difference in the usage of various writers." In the first place it seems sufficient to recognise the three divisions—Palaeozoic, Mesozoic, and Cainozoic, of the Geological Record, or as an alternative—Primary, Secondary, and Tertiary, but even this is not consistently adhered to, for we find the term of Tertiary much more frequently used than the term Cainozoic and associated with the terms Palaeozoic and Mesozoic. We find some authorities recognising five main divisions of the Geological Record,² that is in addition to the above, the oldest division has been variously referred to as Pre-Cambrian, Archaean, Azoic, Eozoic, or Proterozoic, and the youngest as Post-Tertiary or Quarternary. Is there any necessity

¹ An Introduction to Geology, by Professor W. B. Scott, p. 354.

² Text Book of Geology, by Archibald Geikie, 3rd ed., p. 680.

for these additions? For my own part I think not. From an Australian point of view we find Professor Tate in his inaugural address to this Association in 1893¹ remarking, "Thus in Australia, as in other Continental areas, there are developments of Azoic, Palaeozoic, Mesozoic, and Cainozoic rocks; and, moreover, the geological sequence of the chief marine formations are fairly well represented—from Archæan to Permo-Carboniferous, from Trias to Cretaceous, and from Eocene to those deposits now in process of accumulation."

The same author also states,² "It is only in South Australia and West Australia that the metamorphic rocks are actually known to be Pre-Cambrian, but those elsewhere, unless they can be shown to be transmuted Palaeozoic rocks, may be most conveniently referred to the same period. The grandest exemplification of the Archæans is in the Mount Lofty Range of South Australia." Further investigation has changed the face of this question, for Mr. W. Howchin, F.G.S., in a paper contributed to the Royal Society of South Australia in 1897,³ states—"Discoveries have been recently made, however, in these so-called Archæan rocks which have an important bearing on this subject, and on the most convincing evidence determines the basal beds of the Mount Lofty Ranges to be in part, if not wholly, of Lower Cambrian Age."

If the above reasoning of Professor Tate holds at all, it surely means that we have at present only extremely slight foundation, and that perhaps somewhat doubtful, for the use or retention of the term Pre-Cambrian, let alone Archæan, etc.

Even if the retention of the term Pre-Cambrian is found in any way convenient, it certainly seems most suitable to regard it as subsidiary to Palaeozoic and not to rank as an equivalent division. Such palæontological evidence as has hitherto been forthcoming from rocks regarded as Pre-Cambrian outside Australia does not appear in any way to warrant the separation from the Palaeozoic.

Then with regard to Post-Tertiary or Quarternary, these terms are surely superfluous, for all the evidence we have clearly

¹ A.A.A.S., Adelaide, 1893, p. 30.

² *Loc. cit.*, p. 47.

³ Trans. Roy. Soc. S.A., 1897, p. 74.

indicates that we are still within the Tertiary Era, and it is difficult to see the necessity for the introduction of these additions.

We may now make reference to a Table of the Geological Record of the succession of strata as follows :—

TABLE I.

| | | |
|-----------------------------|---|----------------------------|
| Cainozoic or Tertiary | { | Recent. |
| | | Pleistocene. |
| | | Pliocene. |
| | | Miocene. Eocene. |
| Mesozoic or Secondary | { | Cretaceous. |
| | | Jurassic. |
| | | Triassic. |
| Palaeozoic or Primary | { | Permian. |
| | | Carboniferous. |
| | | Devonian. |
| | | Silurian. |
| | | Ordovician. |
| | | Cambrian. Pre-Cambrian. |

Now how far does adherence to such a Table go. Geikie remarks¹—“ By common consent it is admitted that names taken from the region where a formation or group of rocks is typically developed, are best adapted for general use. Cambrian, Silurian, Devonian, Permian, Jurassic, are of this class, and have been adopted all over the globe.”

We find, however, quite a number of additional terms which do not always mean what one would expect from the composition of the term, hence there are different interpretations by various authors, and as a consequence considerable confusion. In the Cainozoic or Tertiary there is not as a rule much confusion. The introduction and use of Oligocene for certain Victorian deposits without proper explanation of the evidence for its use has had peculiar results, for notice the interpretation of our geology even by such a master as Sir Archibald Geikie.² The use of this term has also led the officers of the Geological Survey of Victoria into errors which might otherwise have been avoided, for it has been shown on indisputable stratigraphical and palaeontological

¹ Text Book of Geology, 3rd ed., p. 679.

² *Loc. cit.*, pp. 982, 983, compare with p. 1003.

evidence¹ that their so-called Oligocene actually overlies their so-called Miocene. Further confirmatory evidence of this fact has since been brought forward.

The aspect taken by the present head, Mr. James Stirling, of the Geological Department of Victoria, may be best shown by quoting his remarks,² "I cannot help concurring with my friend Mr. R. M. Johnston, F.G.S., that it is, in the present state of our knowledge, somewhat premature to endeavour to establish a co-relation with the great systematic divisions of the European Tertiary rock system. It is quite probable that when the true relation of the marine and terrestrial deposits of the older Tertiary division is better known, that it may be found necessary to adopt a compound term to define the age of the deposits, such as Oligo-eocene, in a similar manner to that which has been elsewhere adopted for passage beds, as the Jura-Trias in the Mesozoic and Permo-carboniferous in the Palaeozoic life system."

Mr. Stirling however omits to state that in concurring with Mr. Johnston he is going back to that gentleman's opinion first expressed in 1876, and that he is practically ignoring all the subsequent work done on our tertiaries up to 1898, as insufficient for even a relative classification.

Then we have the term Cretaceo-tertiary of Sir James Hector. In introducing this he remarks that "As far as possible the names usually applied to the equivalents of these formations in other countries have been employed, for the convenience of those to whom local names are unfamiliar; but in several instances the natural subdivisions of the strata which admit of being mapped overlap the conventional subdivisions. In such cases local or composite-terms have been used, as, for instance, 'Waipara' or 'Cretaceo-tertiary formation,' which includes the Lower Eocene and Upper Cretaceous of ordinary classifications, for the reason that no division-line that can be used for the purpose of practical geology can be interposed."

Professor Tate refers³ to the New Zealand term as Cretaceo-Eocene. The wandering and modifying tendency is here distinct

¹ Proc. Roy. Soc. Victoria, vol. iv., N.S., part 1, 1892, pp. 9-26.

² Geol. Surv. Vic., Progress Report, No. ix., 1898, p. 123.

³ A.A.A.S., Adelaide, vol. v., 1893, p. 35.

enough, but Sir James Hector's local term fully meets all requirements, even accepting the stratigraphical and palaeontological interpretation to be the correct one. If, however, any mistake has been made in either respect, what becomes of Cretaceo-tertiary? If a time word must be used to give further information, it should not be difficult to fix on a usual one, tentatively at least, with a full explanation of local peculiarities or characteristics.

This method should recommend itself, and at the same time prevent much useless theorising.

Mr. J. E. Marr¹ expresses clearly a valuable point which may have some bearing here, he says, "There is an unconformity between the Cretaceous and Eocene beds of England, which is accompanied by a palaeontological break, but this break is more pronounced owing to difference of physical conditions, for we find abundance of gastropods in the Lower Tertiary beds, and a rarity of these shells at the top of the chalk of England, though where physical conditions were favourable for the growth of gastropods, their shells are found in the higher strata of chalk age, and the palaeontological break is not so apparent."

In the Mesozoic the first departure to note is Super- or Supra-Cretaceous used for what is generally known as Desert Sandstone in Central Australia and Queensland. The first use of this term appears to have been made by Mr. H. Y. L. Brown as Super-Cretaceous,² but as Messrs. Jack and Etheridge say, Mr. Brown does not distinctly aver that the "Super-Cretaceous" rocks described by him lie unconformably on the Cretaceous. Professor Tate and Mr. J. A. Watt in their report on the General Geology of the Horn Expedition³ use Supra-Cretaceous and state, "No evidence of unconformability between Upper Cretaceous and Desert Sandstone was observable between Oodnadatta and the northern confines of the Cretaceous area, though there is some reason for the opinion the latter overlaps the former."

Messrs. Jack and Etheridge in their Geology of Queensland⁴ clearly regard the Desert Sandstone as most conveniently

¹ Principles of Stratigraphical Geology, 1898, p. 65.

² Report of Government Geologist, Adelaide, 1883.

³ Horn Scientific Expedition to Central Australia, Part iii., Geology, p. 65.

⁴ Geology and Palaeontology of Queensland and New Guinea, pp. 1, 3, and 510.

placed in the Cretaceous. The latter view is certainly the most reasonable, and appears to be the most worthy of acceptance, provided these general terms are ultimately accepted for use by colonial geologists.

The next term that attracts attention is Trias-Jura used in the Geology of Queensland by Messrs. Jack and Etheridge. These authors remark¹—"This Series is of the utmost importance, because it contains the chief workable coal-seams in Queensland, or at least the principal seams at present worked. The organic remains are principally those of plants, with a strong Mesozoic facies, and oscillating, in all probability, between the Trias and Upper Oolite in age."

The Rev. J. E. Tenison Woods in his "Fossil Flora of the Coal Deposits of Australia" has, as already remarked by the above-mentioned authors endeavoured to refer many of these plants to horizons corresponding with those of their nearest allies of Europe and elsewhere, and in this way has accounted for the presence in Queensland of the Trias (?), Rhaetic or Lower Lias, Upper Lias and Jurassic. Messrs. Jack and Etheridge then state, "But our knowledge of these plant-beds is too young at present for such minute subdivision, and we know far too little of the association of the species one with the other, and the similar relation of their respective matrices, to assign minute geological horizons, on the chance of a mere guess, or hasty generalisation, turning out correct."

The term Jura-Trias has been used for certain Strata by some American geologists, but, according to Mr. R. S. Tarr,² "the term Newark is now used by the United States Geological Survey to include the strata of the eastern states, which were formerly called Triassic. The Jurassic and Triassic periods are not well developed in America."

In the Palaeozoic we may first note a marked tendency to drop the term Permian out of the systems altogether, for even such an authority as Professor Nicholson, though including in his general classification the Dyas or Permian System remarks,³ "The

¹ *Op. cit.*, p. 313.

² Economic Geology of the United States, 1894, p. 47.

³ Manual of Palaeontology. Nicholson and Lydekker, 3rd edition, vol. i., p. 42.

deposits included under this name are more extensively developed in the European area than they are known to be in any other region, and it is doubtful if they can be regarded as a distinct System."

Then again we find several American authors using Permian as a minor subdivision of Carboniferous of the same value apparently as many of their local names and subdivisions.¹ Yet the necessity for a term intermediate between Carboniferous and Triassic is very striking, and many attempts have been made to satisfactorily fill the gap. Hence the unfortunate introduction of another compound name, Permo-Carboniferous, which is perhaps more misunderstood than most of the other composite terms.

In Australia we notice the late Mr. C. S. Wilkinson, Government Geologist of New South Wales, in his Notes on the Geology of that colony stating,² "The Upper Coal Measures have been provisionally classed as Permian, but it is doubtful whether they should not be regarded as a division of the great Carboniferous Series."

Dr. O. Feistmantel³ indicates the same age terms as Wilkinson, and refers to the age of the Upper Coal Measures, New South Wales, as follows⁴:—"The age of these beds can be easily guessed; they lie above marine beds of Upper Carboniferous age, and consequently most naturally represent the close of the Palaeozoic Epoch, or they can be considered as approximately the representatives of the Permian."

Later in the same work⁵ the above author gives a table in which the term Permo-Carboniferous is used to include in New South Wales: 1. The Lower Coal Measures, 2. The Upper Marine Beds, 3. Newcastle Beds; in Victoria the Bacchus Marsh Beds; and in Tasmania the Mersey River Beds. In a later table⁶ he also includes the Lower Marine Beds, New South Wales, under the same head.

¹ Elements of Geology, J. Le Conte, p. 284 also, Economic Geology of the United States, by R. S. Tarr, p. 47; &c.

² Notes on the Geology of New South Wales, 1882, p. 51.

³ The Coal and Plant-Bearing Beds of Palaeozoic and Mesozoic Age in Eastern Australia and Tasmania, p. 41.

⁴ *Op. cit.*, p. 64.

⁵ *Op. cit.*, p. 66.

⁶ *Op. cit.*, p. 182.

Mr. R. Etheridge¹ gives "the general geological subdivisions of the Carboniferous and Permo-Carboniferous rocks of New South Wales as at present understood by the Geological Survey :"

| | | |
|----------------------|---|---|
| Permo-Carboniferous. | { | Upper Coal Measures. Middle Coal Measures. Upper Marine Series. Lower Coal Measures. Lower Marine Series. |
| Carboniferous. | | |

Further he states,² "The classification formerly adopted by various authors was the subdivision of our New South Wales rocks immediately above the Devonian into Lower Carboniferous, Carboniferous, and Permian. Recent palaeontological investigations will probably lead to a modification of this classification, in so far that the whole of the beds below the Lower Marine Series may be regarded as more truly allied to the Carboniferous simply. On the other hand, that series and the beds above, viz., the Upper Marine and the whole of the Coal Measures, having an affinity with both Permian and Carboniferous might be termed Permo-Carboniferous, "At the same time great caution must be exercised in assimilating our geological subdivisions strictly with those of the old world."

Mr. J. E. Marr may next be profitably quoted from a recent work³ as follows :—"As an illustration of the local character of a palaeontological break we may cite the case of the Carboniferous and Permian systems of Britain. The rocks are separated from one another in our area by a physical and palaeontological break, but in parts of India, and other places, we find a group of rocks now known as the Permo-Carboniferous rocks which contain a fauna intermediate in character between those of the Permian and Carboniferous systems, and a study of this fauna shows that the hiatus which exists locally is filled by the species contained in the Permo-Carboniferous rocks."

As another recent expression of opinion by eminent English geologists, Professor C. Lapworth⁴ states, "In the Permian strata

¹ Monograph of the Carboniferous and Permo-Carboniferous Invertebrata of New South Wales, Part i., Coelenterata, 1891, p. 3.

² *Op. cit.*, p. 4.

³ Principles of Stratigraphical Geology, 1898, p. 64.

⁴ Intermediate Text-Book of Geology, 1899, p. 282.

of Southern India, Australia, South Africa, and South America, the flora of the strata classed as Permian is very different from that of the Permian of Europe, being largely composed of plants of Mesozoic type." And again¹ "In Southern India, Australia, and South Africa, the Permian Beds present us with a still more striking facies. The plants include a majority of forms such as *Glossopteris* and *Phyllothea*, which, in Europe, occur only in Mesozoic strata; and these are sometimes associated with forms like *Sphenopteris* and *Callopteris*, etc., of a Palaeozoic aspect." Following this he refers to the Bacchus Marsh Beds, Victoria, as Permian, the Newcastle Coal Measures in all probability Permian, and a lower marine series and an upper fresh-water series in Queensland as Permian. Now it may be asked how far it is possible to reconcile the above expressions of opinion. It seems to me that instead of the way having been made clearer by the use of the composite term, it has been much encumbered by conflicting and sometimes confusing views, especially to students.

The remarks of Professor David in his presidential address to the Linnean Society of New South Wales in 1893² clearly show some further difficulties that have to be contended with. I make the following quotation:—"Unfortunately the expression Permo-Carboniferous is used with two very different meanings by Queensland and New South Wales geologists respectively. In New South Wales the term Permo-Carboniferous is applied to a group of rocks partly marine partly fresh-water, the fresh-water beds being specially characterised by the prevalence of *Glossopteris* and *Gangamopteris*, while the marine beds contain a fauna partly of Permian and partly of Carboniferous affinities. This is the equivalent of the Middle and Upper Bowen Series of Queensland, but in the latter colony an immense series of older beds is included under the term Permo-Carboniferous, as for example the Lower Bowen, the Star, and the Gympie series."

Then we find Carbonifero-Devonian has been used by Professor David for rocks in the Mount Lambie District of New South Wales.³

¹ *Op. cit.*, p. 234.

² *Proc. Lin. Soc. N. S. Wales*, vol. viii., n.s., p. 584.

³ *Loc. cit.*, p. 582.

Under the head of Devonian in New South Wales the late Mr. C. S. Wilkinson¹ makes the following statement:—"Under this head is classed an important suite of rocks, consisting of sandstones, conglomerates, limestones, and shales, the lower beds of which are related by their fossils to the Silurian and the upper beds to the Carboniferous. Consequently until their stratigraphical relationship has been ascertained by actual survey, some difficulty will be experienced in assigning definite limits to these formations." Subsequently² Mr. Wilkinson remarks on the high state of development of the class Actinozoa in the "Siluro-Devonian Period" as compared with their remarkable diminution in the Carboniferous and Permo-Carboniferous times.

Siluro-Devonian seems to have crept in to stay, for we find other references to it, and descriptions of new fossils from Siluro-Devonian rocks of New South Wales by Mr. R. Etheridge, junr.³

With regard to Cambro-Silurian, here again we have more than the one view as to its exact significance. The general use of this is well expressed by Dr. Kayser.⁴ "It is now almost universally admitted that the Cambro-Silurian rocks fall naturally into three great divisions, each characterised by its own peculiar fauna. Speaking broadly, Sedgwick applied the term Cambrian to the two lower; Murchison at first included in his Silurian the two upper divisions, but ultimately took in a large part of the lowest also. The greater number of geologists, perhaps, apply the term Cambrian to the lowest division, and of Silurian to the two upper." The oscillation of opinion on the use of the general classificatory terms for the subdivisions of Lower Palaeozoic even by our most eminent English geologists is very great indeed, and may perhaps be best shown for our present purpose by the following table copied from the above quoted work:—

¹ Notes on the Geology of New South Wales, by C. S. Wilkinson, 1882, p. 42.

² A Monograph of the Carboniferous and Permo-Carboniferous Invertebrata of New South Wales, Part i., Coelenterata, by R. Etheridge, junr.; Letter of Transmittal, by C. S. Wilkinson, p. vii., 1891.

³ On the occurrence of a Stromatoporoid allied to *Labechia* and *Rosenella*, in the Siluro-Devonian rocks of New South Wales by R. Etheridge, junr., in the Records of the Geological Survey, vol. iv., pt. iii., 1895, p. 134.

⁴ Text Book of Comparative Geology by E. Kayser, Ph.D., translated and edited by Philip Lake, M.A., F.G.S., 1893, p. 29.

TABLE II.

| | Sedgwick. | Murchison. | Geological Survey. | Lyell. | Lapworth. |
|----------------------|-----------|----------------------|--------------------|-----------------|-------------|
| Downtonian. | Silurian. | Upper Silurian. | Upper Silurian. | Upper Silurian. | Silurian. |
| Salopian. | | | | | |
| Valentian. | | | | | |
| Bala Series. | Cambrian. | Lower Silurian. | Lower Silurian. | Lower Silurian. | Ordovician. |
| Llandeilo. | | | | | |
| Arenig and Llanvirn. | | | | | |
| Tremadoc. | | Primordial Silurian. | | Cambrian. | Cambrian. |
| Lingula Flags. | | | | | |
| Menevian. | | | | | |
| Harlech, etc. | | Cambrian. | Cambrian. | | |

Still in the face of this we find Cambro-Silurian used by Tasmanian geologists with a different signification, and again in Canada it is used in some of the Geological Survey Reports with anything but a clear signification. We have then even on this cursory examination a rather peculiar mixture of terms as may be seen from an examination of Table III., and with regard to the interpretation of them, that seems to be a purely optional matter.

TABLE III.

| | | | | |
|-----------------------------|---|--------------|---|--------------------|
| Cainozoic or Tertiary | { | Recent | } | Oligo-eocene. |
| | | Pleistocene | | |
| | | Pliocene | | |
| | | Eocene - - | | |
| Mesozoic or Secondary | { | Cretaceous | } | Cretaceo-Tertiary. |
| | | Jurassic - - | | |
| | | Triassic - - | | Super-Cretaceous. |
| | | | | Supra-Cretaceous. |
| | | Jura-Trias. | | |
| | | Trias-Jura. | | |

| | | | | |
|-----------------------------|---|------------------|---|-----------------------|
| Palaeozoic or Primary | { | Permian - - | } | Permo-Carboniferous. |
| | | Carboniferous | | |
| | | Devonian - - | } | Carbonifero-Devonian. |
| | | Silurian - - | | |
| | | Ordovician - - | } | Siluro-Devonian. |
| | | Cambrian - - | | |
| Pre-Cambrian | } | Cambro-Silurian. | | |

As an expression of British opinion on geological classification I include Table IV., that given by Nicholson and Lydekker in their "Manual of Palaeontology," in which the use and position of Quaternary may be specially noticed.¹

TABLE IV.

| | | | | |
|---------------------------------------|---|-------------------------|---|---------------------------------------|
| Kainozoic or Tertiary Group. | { | Recent Formations. | } | Quaternary or Pleistocene Formations. |
| | | Pliocene System. | | |
| | | Miocene System. | | |
| | | Eocene System. | | |
| | | | | |
| Mesozoic or Secondary Group. | { | Cretaceous System | } | Jurassic System. |
| | | Jurassic System. | | |
| | | Triassic System. | | |
| Palaeozoic Group. | { | Dyas or Permian System. | } | Carboniferous System. |
| | | Carboniferous System. | | |
| | | Devonian System. | | |
| | | Silurian System. | | |
| | | Ordovician System. | | |
| Cambrian System. | | | | |

For the American tangle, Table V. may be examined as given by Mr. Ralph S. Tarr, B.S., F.G.S.A., in his "Economic Geology of the United States," or for additional particulars, if required, reference may be made to James D. Dana's "Text-Book of Geology," or to J. Le Conte's "Elements of Geology."

TABLE V.

| | | | | |
|----------|---|----------------|---|--------------|
| Cenozoic | { | Quaternary - - | - | Recent. |
| | | | | Pleistocene. |
| | | Tertiary - - | - | Pliocene. |
| | | | | Miocene. |
| | | | | Eocene. |

¹ Manual of Palaeontology, vol. i., pp. 41, 42.

| | | | | | | | | | |
|-----------|---|---------------|-------|-----------------------------------|----------|---|---|-------------------|--------------|
| Mesozoic | { | Cretaceous | - | - | { | Laramie. | | | |
| | | | | | | Upper Cretaceous. | | | |
| | | | | | | Lower Cretaceous. | | | |
| | { | Jura-Trias | - | - | { | Jurassic. | | | |
| | | | | | | Triassic. | | | |
| Palæozoic | { | Carboniferous | - | - | { | Permian. | | | |
| | | | | | | Coal Measures. | | | |
| | | | | | | Lower Carboniferous or Sub-Carboniferous. | | | |
| | | Devonian | - | - | { | Catskill. | | | |
| | | | | | | Chemung. | | | |
| | | | | | | Hamilton. | | | |
| | | Silurian | { | Upper | Silurian | - | - | { | Corniferous. |
| | | | | | | | | | Oriskany. |
| | | | Lower | Silurian | - | - | { | Lower Helderberg. | |
| | | | | | | | | Salina. | |
| | | | | | | | | Niagara. | |
| | | | | | | | | Trenton. | |
| Cambrian | - | - | { | Canadian. | | | | | |
| | | | | Upper Cambrian. | | | | | |
| | | | | Middle Cambrian. | | | | | |
| Algonkian | - | - | { | Lower Cambrian. | | | | | |
| | | | | Keweenawan. | | | | | |
| Archean | - | - | { | Upper Huronian. | | | | | |
| | | | | Lower Huronian. | | | | | |
| | | | | Laurentian (Fundamental complex). | | | | | |

For New Zealand the provisional table given by Sir James Hector in his "Outline of the Geology of New Zealand" for the Indian and Colonial Exhibition in 1886, was as follows:—

TABLE VI.

Post Tertiary and Recent.

Pliocene.

Upper Miocene.

Lower Miocene.

Upper Eocene.

Cretaceo-Tertiary.

Lower Greensand.

Jurassic.

Liassic.

Triassic.

Permian.
Carboniferous.
Devonian.
Upper Silurian.
Lower Silurian.

At this stage the question might be reasonably asked, is there any necessity for such confusion of terms? Surely something can be done by this Association to bring about more uniformity, however tentative, in the use of our time scale. We look up various works, papers, and official reports of the various colonies, and from such, we find it absolutely impossible to correlate with any degree of safety even the deposits immediately on opposite sides of the River Murray, let alone the deposits at a somewhat greater distance apart. This appears to be hardly the state of affairs likely to tend to a very permanent advancement of our knowledge of Australian Geology, and that, I take it, should be one of the cares of this section of the Association.

In speaking of the English Record, Sir A. Geikie remarks¹ "The nomenclature adopted for these subdivisions bears witness to the rapid growth of geology. It is a patchwork in which no uniform system or language has been adhered to, but where the influences by which the progress of the science has been moulded, may be distinctly traced." The same authority, as already quoted in the present paper, states that it is generally admitted that the names best adapted for general use are those taken from the region where a formation or group of rocks is typically developed.

Is there nothing typical in Australia? Why is there such a strong tendency towards the use of the British terms, even after it has been proved that the colonial representatives are essentially different in a great many respects. The endeavour to bring this out is apparently shown in the additional introduction of the composite terms already referred to, but surely some local name would meet the present requirements better, until sufficient detailed knowledge of the deposits has been obtained to enable an appropriate general-term to be chosen of local significance.

¹ Text-Book of Geology, 3rd ed., 1893, p. 679.

Bearing on this Professor Tate¹ justly remarks—"The faunal peculiarities of the several formations are, moreover, such as to raise the question—Are we right in adopting the chronology of the European School?" He then goes on to speak of the palaeontological overlap of the Palaeozoic and Mesozoic in the Newcastle Coal-series, and a probable overlap between Mesozoic and Cainozoic. Might there not be ground here for a typical Australian development? Professor Tate's further remarks on this subject² are well worthy of being quoted in full—"The attempts to bring the order of succession of the Australian stratified deposits in unison with that of the country in which so many of the geologists have gained their early impressions have at no time been satisfactory, and the difficulties are daily increasing. Even at an early period of our geological history there had been grasped the important idea that the geology of the typical area of Silurian, Devonian and Carboniferous of Europe was not exactly comparable with that of Australia. This is indicated by the hesitancy on the part of authors to assign a given group of fossils to a definite epoch, and by the discordant results arrived at when the age has been the subject under consideration. Despite the desire to cling to home associations, I think the time is fast approaching when it will be deemed advisable to found an independent school for Australian Stratigraphy."

One of the objects of the International Geological Congress is said to be towards the unification of geological nomenclature throughout the world. This, however, seems to be a somewhat large as well as a difficult undertaking, and it is somewhat doubtful how far a general acceptance would be procured. Still, legitimate work in this direction should receive the utmost consideration and assistance.

Next we come to a source of still further trouble, namely, the application of local British terms to colonial horizons, which, on the face of it, is an absurd stretch at correlation generally upon the most meagre evidence. As a striking instance in this direction, note Professor McCoy's remarks on one fossil, namely,

¹ Presidential Address A.A.A.S., Adelaide, vol. v., 1893, p. 34.

² *Loc. cit.*, p. 35.

*Phascolomys pliocenus*¹ from "the hard ferruginous gold cement of Dunolly,"—"Of great interest as thus showing that our gold drifts are not 'alluvial,' but of the more ancient Pliocene Tertiary period, at least as old as the Mammaliferous Crag; thus corresponding in age with the gold drifts of the Ural."

In Victoria we have in the Palaeozoic the introduction of such subdivisional terms of the Silurian and Ordovician as—Ludlow, Wenlock shales, May Hill sandstones, Bala rock, Llandeilo flags, for which the late Sir Frederick McCoy has been responsible, and as a consequence we find these terms on our geological maps and quarter-sheets, and through our various geological reports. We may also note references to Arenig, Tremadoc and Caradoc.² Is it wise to accept these subdivisions from our colonial work?

We find then, according to Professor McCoy,³ Llandeilo flags or Bala rock to the north of Camp, Lancefield, Llandeilo flags at Bendigo, also in the parish of Bulla, etc.; Bala at Bulla⁴; Wenlock shale at Keilor⁵; May Hill sandstone at Moonee Valley⁶; Upper Ludlow at Johnston-street, Collingwood⁷; and many others needless to quote. The Lilydale limestone has been referred to the Wenlock series by Mr. R. Etheridge, junr.,⁸ and the Rev. A. W. Cresswell.⁹

In connection with the Ordovician Rocks of Victoria, Mr. T. S. Hall in a recent paper¹⁰ remarks, "The general sequence of the Victorian graptolites may be correlated with that of the Northern Hemisphere, but experience has shown that it is unsafe to push the analogy too far, and that the only safe method is that of detailed stratigraphical work. Thus we find forms here associated which elsewhere are separated by intervening zones; and, on the other hand, forms elsewhere associated may be here separated." In our Tertiary series also far too much has been made of resemblances to or differences from English or European representatives.

¹ *Prod. Pal. Vic.*, Dec. i., p. 22.

² Lapworth, *Geological Magazine*; T. S. Hall, *A.A.A.S.*, Sydney, vol. vii., 1898, p. 402.

³ *Prod. Pal. Vic.*, Dec. i., p. 9.

⁴ *Op. cit.*, Dec. ii., p. 36.

⁵ *Id.*, p. 37.

⁶ *Op. cit.*, Dec. iii., p. 20.

⁷ *Op. cit.*, Dec. vi., p. 27.

⁸ *Records of the Australian Museum*, vol. i., No. 3, p. 60, and No. 7, p. 125.

⁹ *Proc. Roy. Soc. Vic.*, vol. v., n.s., 1893, p. 38.

¹⁰ *Geol. Mag.*, n.s., Dec. iv., vol. vi., No. x., Oct. 1899, p. 440.

Thus Professor McCoy has stated,¹ "This does not alter my opinion at all of these deposits which the Geological Survey of Victoria may safely accept on my authority as of newer date than any true Eocene Tertiary type, such as the London clay of the south-east of England, or the corresponding part of the Basin of Paris." Again attributable to the same author from the same report we have—"In the long list of fossils² sent to me there are no species characteristic of indisputable Eocene type sections. By far the greater number of the extinct species are peculiar to the Australian strata, and none of them are found in typical Eocene strata elsewhere." It is to be hoped there are not many colonial geologists or even others to be found to uphold such views as these. The consequence of this is to place much of the work of the Geological Survey of our colony in a very peculiar and rather unenviable position.

This expressed in a brief table, without reference to detailed localities, which may be consulted in a previous paper to this Association,³ appears as follows:—

| Recent Authors. | Geological Survey. |
|-----------------|--------------------|
| Pliocene. | Newer Pliocene. |
| Miocene. | Older Pliocene. |
| Eocene. | Miocene. |
| | Oligocene. |
| | Miocene. |

I feel that this matter has only been very imperfectly brought forward, but if I have been able to show the somewhat chaotic state of things into which we appear to be drifting, this should

¹ Geo. Surv. Vic., Progress Report, No. viii., 1894, p. 48.

² Remarks on the Tertiaries of Australia, with a Catalogue of Fossils by G. B. Pritchard, South Australian School of Mines and Industries Report, 1892.

³ A.A.A.S., Brisbane, 1895, vol. vi., pp. 359-361.

surely call for some action on the part of this Association to at least attempt to draw up and gain recognition for a more uniform system of geological nomenclature for use throughout Australia, so far at least as the main divisions and subdivisions are concerned, and the further minor divisions to be essentially colonial.
